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Demand Forecasting for Rural Transit

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Demand Forecasting for Rural Transit

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16. Abstract

Demand forecasting for rural transit will aid planners in the allocation of resources for this population. A workbook produced by a recent federal effort to develop demand forecasting for rural passenger transportation serves as the starting point of this research project to provide a model for rural transportation planners in Washington State (SG Associates, Inc. 1995). We study the feasibility of their methods for use in Washington State, utilize what can be applied, and develop a series of state-specific rural transit planning models. The three Washington models are based on characteristics of usage for several currently used rural transportation systems. The first model, Total Transit Demand-All (TTD-ALL) uses average values for ridership by population subgroup from four regional transportation systems in Washington to predict ridership for other areas. A second model, Total Transit Demand-FARE (TTD-FARE) uses the same approach as the first but excludes the fare-free regional transportation system. A third, more in-depth model, Disaggregated Transit Demand (DTD), was developed using a separate equation for each population subgroup. The model can be modified by values including the percentage of schoolchildren using the transit system, the percentage of the adult population who commute, the percentage of mobility limited individuals aged 16 to 64 who commute, and the percentage of elderly that use the transit system. These data are not required in order to obtain ridership estimates, but the default values can be modified as data becomes available.

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Summary

Demand forecasting for rural transit is a tool that will aid rural planners in the allocation of scarce resources for this typically underserved population. Private citizens in rural areas who do not drive may find themselves unable to take advantage of social service programs, to receive adequate medical care, to participate in the work force, or in some other way to provide for their basic human needs. A workbook produced by a recent federal effort to develop demand forecasting for rural passenger transportation serves as the starting point of this state-level research project to provide a model for rural transportation planners in Washington State (SG Associates, Inc., 1995). We study the feasibility of their methods for use in Washington State, utilize what can be applied, then develop a series of state-specific rural transit planning models based on existing systems in this state.

The three Washington models are based on the characteristics of usage for several regional transportation systems currently in place in nonmetropolitan areas in Washington State. The first model, Total Transit Demand-All (TTD-ALL) uses average values for ridership by population subgroup from four regional transportation systems in Washington to predict ridership for other areas. Data needs for the model are simple, consisting of total population for the county, population aged 65 and over, the number of mobility-limited individuals, and the number of people living below the poverty level. A second model, Total Transit Demand-FARE (TTD-FARE) uses the same approach as the first but excludes the fare-free regional transportation system which has markedly different characteristics from the systems with fares. A third, more in-depth model, Disaggregated Transit Demand (DTD), was developed using a separate equation for each population subgroup. The model can be modified by values including the percentage of

schoolchildren using the transit system, the percentage of the adult population who commute, the percentage of mobility limited individuals aged 16 to 64 who commute, and the percentage of elderly that use the transit system. These data are not required in order to obtain ridership estimates, but the default values can be modified as data become available. 1990 Census data required by these models and some samples of ridership surveys that can be utilized to provide planners with additional data for fine-tuning their transit models and forecasting transit demand can be found in two appendices.

Demand Forecasting for Rural Transit

Introduction

The very nature of rural areas means that passenger needs are usually met by privately owned and operated personal vehicles. The growth in private automobiles has led to increased independence in rural areas for those who have access, physically and economically, to such vehicles. Overall, this has decreased the quantity demanded for public transportation but increased the intensity of need for those dependent on such services. Public transit systems have become economically infeasible in many rural areas, isolating the non-driving public and making them dependent upon others for transportation.

Demand for mobility in rural towns and areas differs from that in urban areas in that the demand is less efficiently located. The density of movement, with its attendant economies of size, is very low. High costs per trip result from the lack of rural consolidation and longer mileage trips. A fixed route, fixed schedule service may be feasible in some rural towns and areas with sufficient population or coordinated demand patterns. A demand-responsive service may be the only cost-effective way to accommodate the small number of riders in less populated areas. Rural non-drivers may need further transportation assistance once they have reached their initial destination; if taxi service is unavailable, a demand-responsive service could fill this gap.

Non-drivers in isolated rural areas may find themselves unable to take advantage of social service programs, to receive adequate medical care, to participate in the work force or in some other way to provide for their basic human needs. This group includes the frail elderly, youth below the driving age, the physically challenged, persons without cars, one-car families with two-car needs, those without valid driver's licenses, and people whose mental capacities do not allow them to drive. This group often lacks the political leverage that could bring public attention to their problem.

This need for public transit in rural areas and communities is further exacerbated by the increase in retirement couples moving into rural communities. Farm families have historically moved into town upon retirement, usually to make way for the next generation on the farm and to access medical facilities. Today, there is a new demand from families moving to areas of lower housing costs, less crime and traffic, and to "get away from it all." The demands and expectations of these new rural folks tend to be more refined and demanding.

For a number of reasons, funding for research and planning in the area of rural transit has generally been limited. Providing for the transit needs of rural residents has a high per capita cost relative to urban transit due to the dispersion of the population over a large area. Meeting the basic needs of this population group generally takes priority over research and planning projects. In addition, since the costs of establishing or expanding service are relatively small in rural areas, misallocations are less expensive to remedy relative to urban transit investments. Finally, demand models have tended to produce unrealistically large estimates of need and thus have been considered relatively impractical (SG Associates, Inc., 1995). Skepticism for the planning process and the predictive power of transit models is common.

Is planning and demand forecasting really necessary for rural transit? Absolutely. Limited operating funds make planning even more crucial. Without proper coordination, there will be under- and over-served segments of the population. Public transit systems need to be well managed and coordinated in order to increase efficiency and lower the costs per rider. Legislation at different levels requires improved management practices based on monitoring of use and need. For example, the Intermodal Surface Transportation Efficiency Act of 1991 requires a state transportation plan that considers the needs of nonmetropolitan areas under Section 1025. A stated goal of the Washington State Department of Transportation's (WSDOT) State Public Transportation and Intercity Passenger Rail Plan is to provide "safe, reliable, affordable, and convenient" choices for urban, rural, and intercity travel.

The results of a recent federal effort to develop demand forecasting for rural passenger transportation serves as the starting point of this state-level research project to provide a model for rural transportation planners in Washington State. The final report entitled *Demand Forecasting for Rural Passenger Transportation* and the associated *Workbook* (SG Associates, Inc., 1995) prepared for the Transit Cooperative Research Program, the Transportation Research Board, and the National Research Council will be referred to as the TCRP report. We studied the feasibility of their methods for use in Washington State, utilized what could be applied, then developed a series of state-specific rural transit planning models based on existing systems in this state.

This report first presents an in-depth review of the TCRP Report. Next, characteristics of four different county-level systems currently in use in this state are presented; these systems serve as the basis for the models developed in this report. Finally, three models for predicting regional transit demand in rural areas for Washington state are presented. The first two models rely on Census data by population subgroup to predict potential ridership, one based on all four regional transit systems in the study and the other based on the three systems that use fares. The third model is much more detailed and allows for considerable modifications based on specific characteristics of the transit system under consideration.

Review of TCRP Report

The goal of this federal project was to develop straightforward methods for forecasting rural passenger transportation demand using readily available data. Given that rural transit resources for research and planning are extremely limited, models need to be fairly quick and easy to use. This is an inherently difficult task--in modeling, accuracy tends to be sacrificed as models are simplified. A simple national model for rural transit planning at the state or county level would be difficult to develop due to the diversity of the country and its rural population. However, one rich source of data is readily available for each county in the country--the national Census. The TCRP models use detailed data on numbers of elderly and mobility-limited people by county for predicting potential need for rural transit services.

The TCRP Workbook models are designed to estimate demand for passenger transportation services in rural areas, defined as those outside of a Metropolitan Statistical Area (MSA) and with a population density of less than 1,000 persons per square mile. These models were developed using data from a sample of 39 diverse rural counties from across the country. Information on over 200 rural passenger transportation services operating in these counties provided input for the modeling process.

The Workbook demand estimation methodology relies on two distinct types of passenger transportation demand. These are "program-related demand," defined as trips that would not occur but for the existence of specific social service program activities, and "non-program related demand," defined as all other trips. In addition, there are two approaches for applying the developed methodology. The first is an incremental method, designed for use where passenger transportation services already exist. A synthetic method is designed for use where there are no current services for one or more groups.

Program-related transportation is estimated statistically for various categories of social service programs, such as Headstart, job training, or mental health services, based on the number of participants. These equations represent the synthetic demand estimation approach. These simple linear equations estimate the number of annual trips to expect given the level of participants in a particular program (see Table 1). The coefficients for these models are related to the typical number of days of operation of the service and average participation based on the national sample of 39 counties. For example, annual one-way person-trips for those in preschool are estimated by the following formula:

D = 224 X Number of Participants

The coefficient 224 would be 112 roundtrip rides for approximately 22 weeks or five months of classes. Preschool classes may well be conducted less than five days per week over a longer period of time. This coefficient simply represents the average number for those counties that responded to the survey.

The workbook includes about a dozen similar equations for different types of social service programs (see Table 1). Unfortunately, many of the estimates were performed with just a few valid samples (three counties out of the entire nation for *Developmental Services: Case Management*; two counties for *Developmental Services: Preschool*; two counties for *Headstart-Homebase*; two counties for *Headstart-Other*; and two for *Mental Health Services: Case Management*). Moreover, the categories used in the Workbook do not necessarily coincide with specific programs a county may have. For example, senior nutrition and nursing home numbers may be confounded by the fact that the seniors' meals are served at the nursing home, as is the

TABLE 1: Recommended Methodology for Estimating Annual Program Related Rural Passenger Transportation Demand

D = Annual One-Way Person-Trips

<u>*PROGRAM TYPE*</u>:

Developmental Services: Adult

Participants < 25; D = 358 x Number of Participants

Participants > = 25; D = 430 x Number of Participants - 1,686

Developmental Services: Case Management

D = 39.2 x Number of Participants

Developmental Services: Pre-School

D = 224 x Number of Participants

Group Home

Participants <10: D = 2.05 x Number of Participants x Days of Operation

or, if the number of days of operation is not known, D = 615 x Number of Participants

Participants > 10: D = (1.42 x Number of Participants + 5.94) x Days of Operation

or, if the number of days of operation is not known, D = 291 x Number of Participants + 3,760

Headstart

D = 263 x Number of Participants

Headstart Home Base

D = 0.1 6 x Number of Participants x Days of Operation or, if the number of days of operation is not known, D = 30.5 x Number of Participants

TABLE 1: Recommended Methodology for Estimating Annual Program Related Rural Passenger Transportation Demand (cont.)

D = Annual One-Way Person-Trips

<u>*PROGRAM TYPE*</u>:

Headstart: Other

D = 1.86 x Number of Participants

Job Training

D = 137 x Number of Participants

Mental Health Services

D = 347 x Number of Participants

Mental Health Services: Case Management

D = 6.35 x Number of Participants

Nursing Home

Participants < 50; D = 9.10 x Number of Participants

Participants > = 50; D = 12.5 x Number of Participants - 173

Senior Nutrition

D = 248 x Number of Participants

Sheltered Workshop

D = 1.58 x Number of Participants x Days of Operation or,

if the number of days of operation is not known,

D = 384 x Number of Participants

case in Whitman County, Washington. In this example, the number of program participants does not coincide with the number needing transportation. It is dangerous and difficult to try to apply these formulae to specific programs, as the categories and equations are very general. Moreover, averages from two or three rural counties in the survey are unlikely to be good predictors of actual need for other rural counties across the country, particularly when looking at one specific county.

Methods are also presented for estimating program-related demand in the absence of data on program participation. These methods rely on characteristics of the population as provided by US Census data. In the case of Washington State, other data requirements of the model, such as the number of vehicle miles available for certain segments of the population, were only available at the multi-county level. Census data might allow some type of proportional weighting by county when data are only available at the regional level, but accuracy would be sacrificed.

In the Workbook, nonprogram-related demand is estimated as a function of the size of the three population groups most likely to use a rural passenger service (the elderly, persons with mobility limitations, and persons in poverty), the size of the service area, and the amount of service available to each of these three population groups in terms of annual vehicle miles (see Table 2).

There are several fundamental problems with the model in Table 2 used to estimate these demand relationships. The first is the use of the area of the county in the denominator and the number of vehicle miles available in the numerator in the demand equation. Statistically, this assumes that the proportion of road use to area of the county will be a determining factor in demand for a passenger service. The ability of this coefficient to accurately predict demand for

TABLE 2: Recommended Methodology For Estimating Annual Non-program Related Rural Passenger Transportation Demand

$$D = R_e E(1/(1 + k_e e^{-U_e})) + R_m M(1/(1 + k_m e^{-U_m})) + R_p P(1/(1 + k_p e^{-U_p}))$$

where:

D = annual demand for Non-Program Related passenger transportation (One-Way Trips per Year)

R_e = 1,200

R_m = 1,200

R_p = 1,200

E = number of persons age sixty or over.

M = number of mobility limited persons age sixteen to sixty-four.

P = number of persons, age sixty-four or less, in families with incomes below the poverty level (as defined in the 1990 U.S. Census).

$k_e = e^{6.38}$

$k_m = e^{6.41}$

$k_p = e^{6.63}$

$$U_e = 0.000510 \times \frac{\text{Annual Vehicle-Miles Available to Elderly Market}}{\text{Area of the County}}$$

$$U_m = 0.000400 \times \frac{\text{Annual Vehicle-Miles Available to Mobility Limited Market}}{\text{Area of the County}}$$

$$U_p = 0.000490 \times \frac{\text{Annual Vehicle-Miles Available to Low-Income Market}}{\text{Area of the County}}$$

counties in Washington State relies on the assumption that the characteristics of the road use and terrain and their relationship to rural transit demand in the 39 counties in the survey are similar to those in Washington State's rural counties. In this state alone, these characteristics will vary considerably from one county to another.

The second major problem with the demand equation in Table 2 is the lack of county-level data to estimate annual vehicle miles by population subgroup in Washington, and probably other states as well. A number of individuals at the state and county levels were contacted in an attempt to gather the necessary data to test these models (Johansen, personal communication; Riemel, personal communication; Meury, personal communication; and White, personal communication). As is noted in the TCRP report (SG Associates, Inc., p. 74), few agencies in the 39 county sample were able to provide vehicle miles for each population subgroup. The best they were able to obtain were data or estimates of total nonprogram ridership for all groups. They estimated the coefficients for each subgroup in the demand equation using an iterative process until reasonable results with low error were obtained. Since information on vehicle miles by these subgroups is not generally available, these data would have to be collected in order to utilize the TCRP method, which could be potentially troublesome. Each rider would have to be classified into one of the three groups: elderly, mobility-limited, and below the poverty level. In addition, the ride would have to be nonprogram related. Often there is no actual distinction between program and nonprogram related transit services. The massive effort required to gather this data (assuming people were willing to provide it, which could be personally intrusive and perhaps violate some type of privacy or ethical statute) is not cost effective given the lack of breadth in the sample used to construct the initial model in the first place.

In Washington State, county-level data required by the nonprogram related demand model are not available. Information on the number of vehicles in service and annual ridership is available for each of the 13 Medicaid broker regions in Washington State. Medicaid brokers are key facilitators of paratransit services for persons with low income. However, these regions aggregate the rural counties in the state into very large blocks. King, Pierce, Snohomish, and Spokane counties make up four regions, with the remaining 35 counties covered by nine Medicaid regions. If data on actual miles for these vehicles were available, we would still have the problem of disaggregating by county and then again by population subgroup. A sketchy estimate could be made based on population characteristics by county. Alternatively, county population characteristics could be aggregated to match that Medicaid broker group. The TCRP workbook provides information on typical mileage by type of vehicle in service, but there is a very large variance in the national numbers used to estimate this average so the reliability is understandably low when individual situations are investigated.

While these rural transit demand models provide the relevant variables to be used, they do not provide a practical solution for rural transit demand estimation for many reasons. Data required for using the model are simply not available in most cases. Often, there is no actual separation between program and non-program related ridership; obtaining separate ridership figures by these two characteristics may be unrealistic. In addition, the model is only designed to work for counties for which the largest town has a population between 5,000 and 10,000, and the model should not be used if there are any fixed route transit services being used already (Spielberg, personal communication). Thus, this very general model developed for national use would be unlikely to have the desired predictive power for any one county in this state and there are a number of counties for which the models would not be applicable.

In the conclusions of the final report issued by the TCRP on this workbook, it was stated that the "primary shortcomings relate to the lack of consistent and readily available data for use in analysis of the travel patterns of rural households, and consistently reported data on services supplied by rural transportation providers." Earlier, in the section detailing demand estimation, they point out that very few agencies in the 39 county sample were able to provide vehicle miles available by population subgroup. It is therefore unrealistic to assume that laypeople will be able to use an equation that requires these data. Indeed, applications of these models have been used in just three locations nationwide (Kansas, North Carolina, and New Mexico), with varying success rates (Spielberg, personal communication).

In a discussion with the model developers, they admit that synthetic estimation procedures are unlikely to be very accurate (Spielberg). They felt that the incremental estimation process was much more accurate, however, as the particular travel characteristics of a region will be reflected in the current usage statistics. However, these procedures were also developed using the same small and sporadic national sample.

In this study, the peer group analysis approach was used to develop models for Washington State. Essentially, the peer group analysis approach uses information on similar transit programs in the region under study as models. Theoretically it makes sense that transit programs for similar regions should have more in common than ones that are in different regions of the country. Characteristics of the population and the transportation infrastructure are more likely to be similar, thus producing a more constructive model than a random sample of transit systems for the entire country, as used in the TCRP approach. All of the relevant regional transit systems in the state were contacted and asked to provide data on ridership by population subgroup as well as other characteristics of their transit systems. This input provided the data for the models in this study.

Washington State Rural Transit Models

Three Washington-based models were developed based on the characteristics of usage for four regional transportation systems currently in place in nonmetropolitan areas in Washington State. The first model, Total Transit Demand-All (TTD-ALL) uses average values for ridership by population subgroup from four regional transportation systems in Washington to predict ridership for other areas. Data needs for the model are simple, consisting of total population for the county, population aged 65 and over, the number of mobility-limited individuals, and the number of people living below the national poverty level. All of this information is readily available from Census data. It is also provided in Appendix A of this report. A second model uses the same approach as the first, but excludes the fare-free regional transportation system which has markedly different characteristics from the systems with fares. Ridership data from the three systems that have fares are used to produce coefficients for the second model, Total Transit Demand-FARE (TTD-FARE).

A third model, Disaggregated Transit Demand (DTD), was developed using a separate equation for each population subgroup. The model can be modified by values including the percentage of schoolchildren using the transit system, the percentage of the adult population who commute, the percentage of mobility limited individuals aged 16 to 64 who use transit services, and the percentage of elderly that use the transit system. These data are not required in order to obtain ridership estimates, but the default values can be modified as data become available or if planners feel they have estimates that are better than the default values. This allows planners to tailor a model to reflect the individual characteristics of a region and its transit system. The model coefficients were adjusted for each of the four regional transportation systems in this study in order to reflect ridership characteristics by subgroup.

Users of this model may want to use the values for the transit system in this study that is most similar to their county in terms of the type of services offered. This model has the potential to be much more accurate than the first two Census-based models, particularly if additional data or surveys are conducted to determine the correct values for the coefficients in the model. Ultimately, an individualized, complex model for each regional transit system could be developed as relationships between transit need and usage are uncovered. A model for any particular area will necessarily need to reflect site-specific regional characteristics and will change over time as well. These models, based on other Washington transit systems, provide a reasonable starting point.

Several secondary data sources are available that provide useful information for transit planners. Census data for each county are provided in Appendix A. Population trends and forecasts are available from the Census Bureau. The number of schoolchildren currently enrolled in kindergarten through twelfth grade is available in the Washington State Fact Book that is published every other year by the Washington State Office of Financial Management. The Department of Social and Health Services has detailed statistics on the number of people in each of their programs for each county (Meury, personal communication, 1998). Current participation for programs that use or would use transit services, if available, may be useful.

Surveys of the population currently using transit systems as well as the general population can be very useful in determining response to changes in services, especially if these surveys are conducted in the area under study. Some examples of these types of surveys used by LINK in Douglas and Chelan counties are presented in Appendix B. Another resource for improving demand estimation of transit services is the people currently working in these systems. Surveys of those working in these transit systems--dispatchers, drivers, administrators--are often able to give policymakers reliable local information that secondary data sources cannot provide.

Case Studies and Development of Models

Four regional transit systems located in rural areas in Washington State were able to provide detailed ridership data for use in this model (Figure 1). They include Clallam Transit in Clallam County, Jefferson Transit Authority in Jefferson County, Pacific Transit System in Pacific County, and LINK in Chelan and Douglas counties. Data from these systems were used to develop and test the predictive power of models which use population and ridership data to predict transportation demand. These were the only identified systems that operated in primarily rural areas on a county-wide basis that were able to provide detailed ridership data. It is apparent that separate models for public transit in rural and urban areas are needed due to substantial differences in these services. Even within these rural counties, different types of transit services are demanded. For example, some counties have public transit routes that are timely for

Figure 1 Case Study Regional Transportation Systems

transporting schoolchildren. In these cases, population data and model coefficients for this group will be needed.

The following table presents the ridership data collected for each of the case study transportation systems. Riders per year by population subgroup were provided by each case

Table 3: Comparison of Ridership Data and Population by Case Study Counties

Transit System/ Population by Subgroup	Riders/year	Population	Rides/person/yr
Chelan-Douglas:			
Youth (<18)	619,576	22,090	28
Regular (18-59)	873,337	41,532	21
Senior (60+)	147,642	14,833	10
Mobility Limited (ages 16-64)	49,042	702	70
TOTAL	**1,689,597**	**78,455**	**22**
Pacific:			
School service (est.)	15,651	3,622	4
Adult 19-62	180,323	9,587	19
Senior >62	27,607	4,734	6
Mobility Limited (ages 16-64)	9,014	231	39
TOTAL	**232,595**	**18,882**	**12**
Clallam:			
Youth (<19)	260,841	14,606	18
Regular riders (ages 16-64)	308,652	32,636	9
Elderly (65+)	106,492	11,528	9
Mobility Limited (ages 16-64)	101,246	813	125
TOTAL	**777,231**	**56,464**	**14**
Jefferson			
Children (<=6, with adult)	7,804	1,595	5
Youth (<18)	62,532	2,984	21
Adult (18-59)	95,418	10,051	9
Senior (60+)	23,036	5,517	4
TOTAL	**224,010**	**20,146**	**11**

transportation system.[1] County population by subgroup was estimated from 1990 US Census data. LINK in Chelan and Douglas counties has the highest average ridership at 23 rides per person per year, probably due to the fact that it is the only fare-free system in this study. Voters

[1]Note that there were no state-wide standards for data collection categories, so the groupings by population categories differed somewhat from county to county. These categories did not always provide an exact match to US census data, so some extrapolation was used in the modeling process.

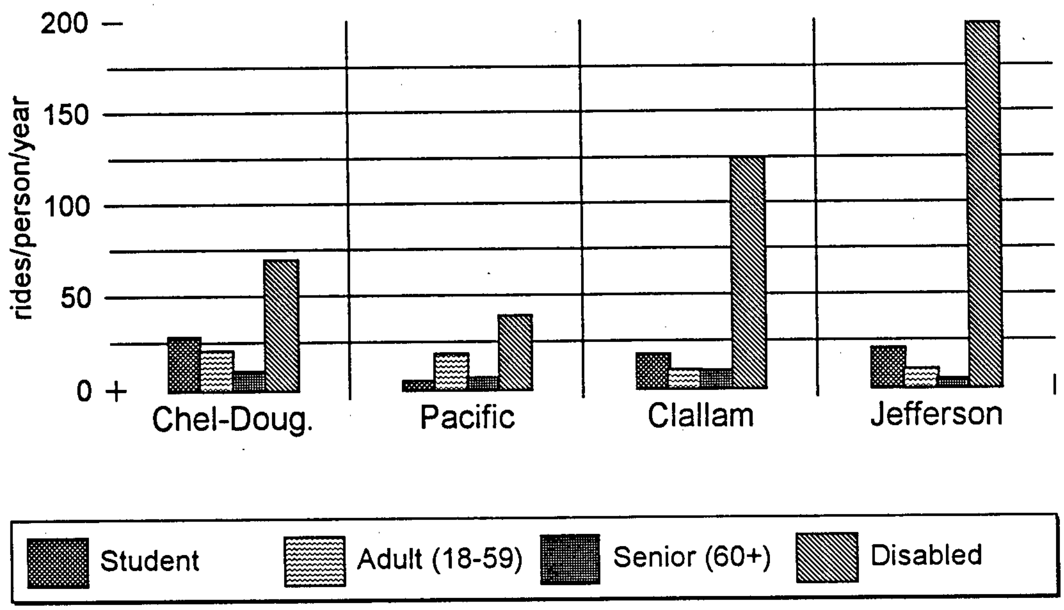

Figure 2 Case Study Ridership By Population Subgroup (rides per person per year)

Jefferson Transit Authority (JT)

JT has seven fixed routes as well as a variety of other services including vanpool, ridematching, route deviation (fixed route but with the flexibility to accommodate passengers within a small radius of the route), regional and intercity bus connections as well as connections with Washington State Ferries. Several fixed route services provide easy transit access to the county's public schools. Paratransit services for persons with disabilities are provided by a private, nonprofit operator under contract with JT. Connections to the ferry terminal and to Kitsap Transit are provided seven days a week. Connections to Mason County and Clallam County transportation services are also available. JT began revenue services in the eastern part of the county in 1981 and connected service along the Pacific Ocean in January 1995.

LINK in Chelan-Douglas

LINK operates 17 fixed routes, three point deviation (also known as route deviation) routes, and paratransit. Seasonal transit services are provided to the ski area and the county fair. Ridesharing and vanpool programs are offered as well. LINK provides services to regional and municipal airports as well as the Lake Chelan Ferry. Bus service is also provided to the Amtrak and Greyhound depots in Wenatchee. LINK has routes that pass by all of the public schools in the area and services the Wenatchee Valley College. LINK began operations in December of 1991.

Pacific Transit System (PT)

PT has six fixed routes in the county. Paratransit service is provided to those with disabilities as well as to persons without easy access to fixed-route services. Fixed-route services provide timely access for public schoolchildren. In addition, PT services Grays Harbor Community College in Aberdeen from the towns of Raymond and South Bend. PT has been in operation since 1980.

Estimation of Ridership Using Secondary Data

In this section, different models for estimating ridership are presented. Easily accessible secondary data from the Census of Population and the Washington State 1995 Fact Book (Office of Financial Management) provide the input for these models (see Appendix A). Since demand will always be responsive to price and quality of service factors, these models provide a starting point for transit planning. Predicting potential ridership for areas without transit services will be difficult, but by closely examining existing systems in this state, reasonable estimates are within reach.

Total Transit Demand-All (TTD-ALL) Model

The first model will be called Total Transit Demand-All (TTD-ALL), developed using data from four Washington State transit systems. The coefficients for ridership for several population subgroups are obtained using the average values (number of rides per person per year that uses the transit system, see Table 3) for the four systems in this study, with each transit system weighted equally. It takes the form of:

$$TTD\text{-}ALL\text{: } Predicted\ Rides\ Per\ Year = \frac{7.3*ELD+15*POP+100(ML16\text{-}64+MLOVER64)}{\%POPABOVEPOV}$$

where *ELD* is the population aged 65 and over, *POP* is the total population for the county or countiezs, (*ML16-64* and *MLOVER64*) is the population aged 16 and over that is mobility limited, and *%POPABOVEPOV* is the percent of the population living above the poverty level in that county. Using the variable *%POPABOVEPOV* in the denominator serves to increase the demand for transit services as the percent of the population living above the poverty level declines. The TTD-ALL model did a very good job of estimating ridership for LINK, as can be seen in Table 4. Ridership for the other three systems was overestimated by 62% to 112%. Since LINK is a fare-free system and the other three are not, it would be expected that demand is diminished in the presence of fares.

Table 4: Estimation of Ridership per Year by Transportation System Using Equation 1

	Chel-Doug.	Pacific	Clallam	Jefferson
Predicted Ridership	1,674,552	461,084	1,306,569	437,842
Actual Ridership	1,692,480	216,944	806,898	224,010
Difference	17,928	(244,140)	(499,671)	(213,832)
% error	1.06%	-112.54%	-61.92%	-95.46%

Total Transit Demand for Fare Systems (TTD-FARE) Model

To provide a better model for systems charging a fare, coefficients for these variables were estimated using the average values for the three systems with fares. This model, Total Transit Demand for Fare Systems (TTD-FARE), takes the following form:

$$TD\text{-}FARE\text{: } Predicted\ Rides\ Per\ Year\ = \frac{6.4 * ELD + 12.5 * POP + 120(ML16\text{-}64 + MLOVER6}{\%POPABOVEPOV * 1.7}$$

Coefficients for each of the variables in the TTD-FARE model were obtained from the average values for ridership for systems with fares (see Table 3). Average values for the three transit systems with fares were 17% lower for the population in general, 12% lower for the elderly, and 20% higher for the disabled than the average values for all systems including the fare-free system (see Table 5). Proportionately higher ridership by the disabled in areas with fares may well reflect the fact that their fares are subsidized. In addition, the adjustment for the impact of the population below poverty level is greater in this model due to the fares, so the coefficient on this variable was increased by 70%. This model predicts actual ridership most accurately for Jefferson County; there is only a 1% difference between actual and predicted ridership. For Pacific County, predicted ridership was 13% higher than predicted, while the estimate for Clallam County was

14% lower than actual ridership (Table 5). For all three counties combined, the total predicted ridership was 6% lower than actual ridership.

Table 5: Estimation of Annual Ridership For Systems With Fares

	Pacific	Clallam	Jefferson	Total
Predicted Ridership	245,257	696,162	227,194	1,168,613
Actual Ridership	216,944	806,898	224,010	1,247,852
Difference	(28,313)	110,736	(3,184)	79,239
% error	-13%	14%	-1%	6%

Disaggregated Transit Demand (DTD) Model

In an attempt to develop a model with the potential for greater accuracy than the simple models presented above, a disaggregated model was developed with variables that can be adjusted to reflect different characteristics for each county. For example, if a large percentage of schoolchildren regularly commute, this factor will be captured in that segment of the model, improving overall accuracy of the total ridership estimate. The Disaggregated Transit Demand (DTD) model estimates ridership for each population subgroup separately. Fares are not explicitly taken into account; these models could represent systems with or without fares. Average coefficients representing ridership by population subgroup reflect price and quality factors of the four systems upon which these models are based. The entire set of equations in presented is Figure 3. Each equation is explained in detail below.

The first equation takes the following form:

DTD-1: Youth Ridership = (*SCHOOLAGE*)(360)(*%transit for school*)

Figure 3: Equations for the Disaggregated Transit Demand Model

DTD-1: Youth Ridership = *(YOUTH)*(360)(*%transit for school*)

DTD-2: Adult Ridership = *(ADULT)*(572)(*%commute*)

DTD-3: Senior Ridership = *(ELD)*(104)(*%eldcommute*)

DTD-4: Mobility-Limited Ridership = *(MLADULT)*(626)(*%mlcommute*)

TOTAL TRANSIT DEMAND = DTD-1 + DTD-2 + DTD-3 + DTD-4

where *SCHOOLAGE* is the number of persons enrolled in kindergarten through 12th grade, 360 represents the number of one-way trips for a school year with 180 school days, and *%transit for school,* representing the percentage of schoolchildren using transit services, is an estimated coefficient that can be varied from county to county. Values for capitalized variables can be readily obtained from secondary data sources including the U.S. Census (1990 values are available in Appendix A) and, in the case of *SCHOOLAGE*, the State Office of Financial Management (see county profiles in the Washington State 1995 Fact Book). Values for lower-case variables will typically vary somewhat from region to region. These values can be easily estimated if planners have data on the number of rides for each population subgroup as illustrated in the following equation:

$$\%\ transit\ for\ school = \frac{(total\ rides\ by\ students\ per\ year)\ /\ (360)}{total\ number\ of\ students \in transit\ area}$$

In this case, schoolchildren who commute to school only will normally have 360 one-way trips per school year. Dividing the total youth ridership by 360 yields an estimate of the number of youth who use transit services to commute to school. The percentage of youth who commute to school (*%transit for school*) is then easily obtained by dividing the estimate of number of youth who use the transit by the total number of schoolchildren in the transit area. These predictions ignore other reasons for youth ridership which may need to be addressed if planners feel there is substantial youth ridership for activities unrelated to school. Of course, one would need statistics on ridership by youth to make these estimates; in the absence of these statistics, estimates from similar systems could be used. School officials may also be able to provide estimates for the percentage of schoolchildren who use transit services.

DTD-2: Adult Ridership = *(ADULT)(572)(%commute)*

where *ADULT* is the population aged 18 to 64, *572* represents the number of one-way rides assuming 5.5 roundtrip rides per week, and *%commute* is the percentage of the adult population that commutes on a regular basis. The value for *%commute* can be estimated separately for each individual county to reflect different areas of the state. In this study, ridership values by adults for each county were used to estimate the value for %commute using various values for the number of rides per week. The assumption of 5.5 roundtrip rides per week performed better on average for the four counties in this study than either 5 or 6 roundtrip rides. Further sensitivity analysis for any particular region and ridership surveys could improve these estimates. Once a reasonable estimate for the average number of rides per week is obtained, an estimate for the number of adults who commute is obtained by dividing total rides for this subgroup by total rides per year. The percentage of adults who commute *(%commute)* is then determined by dividing the number who commute by the total number obtained from Census statistics. A representative survey of transit riders could also be used to obtain the average number of rides per year for this subgroup, which can then be used to estimate the percentage of the adult population that uses transit services. In the absence of other data, the values listed in Table 7 estimated from data obtained from the county-wide systems in this study can be used. The predicted values for this group had nearly a 2% error overall in predicting actual values across the four systems, which was much larger than the percentage prediction error for schoolchildren and the mobility-limited population but not quite as large as that for the elderly population.

DTD-3: Senior Ridership $= ELD * 104 * \%eldcommute$

where *ELD* represents the population aged 65 or over, the value 104 represents two roundtrip ride on the transit system per week, and *%eldcommute* is an estimate of the percentage of the elderly population that uses the transit services. The value for *ELD* is readily obtained from census data (see Appendix A). The assumption of two roundtrip rides per week may or may not be accurate for any one area; a representative ridership survey would provide a better estimate of this value. The percentage of elderly who commute can then be estimated from ridership statistics. The number of rides by the elderly divided by the average number of rides per elderly person per year results in an estimate of the number of elderly persons using the transit system. That number, divided by the total number of elderly persons in the study region, yields the percentage of elderly who use the transit system, or *%eldcommute*. Similar to the previous equation, the predicted values for this group had a 2% error overall in predicting actual values across the four systems. The choice of one average value for weekly ridership does not provide a perfect fit across the four systems; perhaps the behavior of schoolchildren and the non-elderly mobility limited population is more predictable than that of the regular adult population and the elderly population.

DTD-4: Mobility-Limited Ridership= *MLADULT**626**%mlcommute*

where *MLADULT* represents the population aged 16 to 64 classified by the Census as mobility limited, 626 represents six roundtrip rides on transit services every week, and *%mlcommute* is an estimate of the percentage of the non-elderly adult population with mobility limitations that uses the transit services. The estimate of six roundtrip rides per week for this group provides reasonable estimates for this subgroup. In fact, these estimates produced the best predictions for ridership of the four equations. Summing across the four transit systems, there was 0.01% difference in predicted versus actual ridership. The ridership of mobility-limited elderly was not estimated separately in this model; it was assumed that these riders are more likely to have transit needs similar to the elderly population that uses transit services.

The sum of equations 1 through 4 gives the total ridership estimate. This should provide better results than the more general models using average values presented in the TTD-ALL and TTD-FARE. As data become available, the model can be updated and improved for each county. For these models, approximate values for coefficients were obtained using ridership data by subgroup provided by each transit system. The results are presented in Table 6 below. Better estimates could be obtained with additional data on the different subgroups that use public transit each year. Surveys of the general population could be used, but these are costly and people tend to overestimate ridership in general surveys (SG Associates, 1995). Ridership surveys are generally a less expensive and less time consuming method for obtaining estimates of

Table 6 Comparison of Predicted to Actual Values for Ridership Estimation Equations by Regional Transportation System

	Chelan-Douglas		Pacific		Clallam		Jefferson	
Ridership:	*Predicted*	*Actual*	*Predicted*	*Actual*	*Predicted*	*Actual*	*Predicted*	*Actual*
SCHOOLAGE	619,635	619,576	15,655	15,651	260,833	260,841	62,562	70,336
ADULT (16-64)	1,001,241	873,337	202,260	180,323	308,495	308,652	113,326	95,418
ELDERLY (65+)	136,247	147,642	28,061	27,607	125,254	106,492	21,566	23,036
MOB. LIM.16-64	49,043	49,042	9,009	9,014	101,228	101,246	35,222	
TOTAL	1,806,167	1,689,597	238,043	232,595	795,810	777,231	232,677	224,010
Difference	116,570		22,390		18,579		8,667	
% ERROR	7%		10%		2%		4%	

average number of rides per year by different population subgroups than surveys of the general population. Unlike other models, this model classifies riders into fairly easily identifiable subgroups that do not require further classification by characteristics that might be deemed offensive, such as income level or race.

Planners may wish to change the values for the coefficients in the model, such as the percentage of the population aged 16 to 64 that commutes regularly and the percentage of school children that use the transit system. Values for selected coefficients used in the model are presented in Table 7. Planners should choose values for a county or transit system that seems most similar to one they are studying. They may find that some fairly simple data gathering will improve the estimates obtained from these models. For example, a statistically representative survey of persons classified as mobility limited would not require a large number of surveys in most cases. Secondary data sources may also provide some of the data needed to correctly

Table 7. Values for Selected Coefficients By Transportation System

	Chel-Doug.	Pacific	Clallam	Jefferson
Total population *(POP)*	78,455	18,882	56,464	20,146
SCHOOLAGE population (K-12)	17,008	3,424	10,063	3,598
ADULT population (18 to 59)[1]	41,532	9,587	32,636	10,051
ELDERLY population (60 and over)[1]	14,833	4,734	11,528	5,517
Mobility-limited population aged 16 to 64 *(ML16-64)*	702	231	813	178
Percent of youth using transit for school *(%transitforschool)*	10.12%	1.27%	7.20%	4.83%
Percent of adults who commute regularly *(%commute)*	3.36%	3.00%	1.51%	1.52%
Percent of population 65 and over who commute regularly *(%eldcommute)*	11.16%	6.23%	19.89%	31.61%
Percent of mobility-limited population under 65 who commute regularly *(%mlcommute)*	12.76%	7.47%	11.84%	5.35%

[1] Population data were adjusted to fit the ridership statistics available in each region. For example, elderly were classified as 60 and over for the Chelan-Douglas and Jefferson transit systems, so the matching statistic from the Census was used for this area. For Pacific Transit, seniors are classified as over 62, so the midpoint for the number of people aged 60 and over and the number aged 65 and over from the Census was used. Clallam Transit classifies elderly riders as those aged 65 and over, so this matching Census statistic was used. The appropriate classification for the adult population was modified accordingly.

estimate these equations. Planners may have a better idea of the underlying structure of the demand for transit services by a particular subgroup and may want to substantially modify the estimation technique. Hopefully, this model has provided a starting point for developing accurate equations for predicting transit need and demand for underserved areas around the state.

Conclusions

The TCRP Model was thoroughly reviewed for its applicability in estimating rural transit demand in Washington State. However, the data requirements for using the TCRP models were unrealistic; much of the data was not available or readily obtainable. Given the extremely small sample size used to create the TCRP models, it would be heroic to find that they accurately predict demand for Washington State systems, even if the necessary data could be obtained. However, the Workbook does provide a great deal of useful background information including other models that have been used in past studies. An approach using peer analysis, which studies transit systems in similar areas, was chosen for this particular study as it seemed most likely to generate reasonable and applicable estimates for this state.

Models with varying levels of complexity are presented for predicting ridership on public transportation systems for county-wide systems. The first model, Total Transit Demand-ALL (TTD-ALL), provides an easy way to make an initial estimate of potential ridership for fare-free transit systems similar to LINK in Chelan and Douglas counties. Since demand for a transit system will be dependent on both price and quality of services provided, and this model provides an excellent fit for this two-county system, one may assume that the underlying characteristics of the system and/or the population are responsible for the good fit. In the second model, Total Transit Demand-FARE (TTD-FARE), ridership for the three transit systems with fares located on the Washington coast were estimated using coefficients obtained from average values for these three systems. This model provided the closest ridership estimate for Jefferson County, with just 1% difference between actual and predicted ridership. The estimate for Pacific County was 13% higher than actual ridership, while the estimate for Clallam County was 14% lower than actual ridership. The third model, Disaggregated Transit Demand (DTD) is more refined in terms of estimation techniques and is also more flexible. This model predicted ridership very accurately for schoolchildren and the mobility limited population subgroup with less than 1% error. Estimates for the adult population and the elderly population averaged 2% error over the four systems.

This model uses ridership data by subgroup to estimate the percentage of that subgroup that uses transit services by estimating average rides per year for each population subgroup. Planners can easily tailor these models to individual regions by using different values for various coefficients based on data or their informed estimates. Finally, simple on-board surveys, surveys of affected individuals, or general population surveys may be conducted to refine the data used for this model. The models are easy to understand and alter.

Accurate models for predicting rural transit demand will need to be tailored to each individual region and its population. Characteristics including the location of different services in a specific region that will generate transit need, such as medical and shopping centers, will obviously be important. In addition, the location of roads and other physical characteristics of an area can be a determining factor for transit flows. Surveys of the population can help planners determine the relationship between need and demand, although respondents sometimes tend to overestimate their actual usage. As sophisticated Geographical Information Systems become available, many different types of transit-related characteristics can be mapped, providing for coordination among transit providers and, possibly, the development of extremely accurate transit models. These models will need to reflect the dynamic nature of transit need and demand, which is dependent on a myriad of factors including population demographics, public services provided, economic cycles, and the price and quality of transit services, among others. Hopefully, an increased understanding of the relationships between these characteristics will help develop transit systems provide superior systems for all citizens in both rural and urban areas.

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Appendix A

1990 U.S. Census Data for Model Estimation

Appendix A Table 1: Selected Census Data By County (1990 Census)

County	Population No.	Rural population No.	Rural population %	Persons aged 65 & up No.	Persons aged 65 & up %
Adams	13,603	8,965	66%	1,527	11%
Asotin	17,605	4,107	23%	2,919	17%
Benton	112,560	14,404	13%	11,399	10%
Chelan	52,250	24,913	48%	8,188	16%
Clallam	56,464	29,657	53%	11,528	20%
Clark	238,053	52,982	22%	25,433	11%
Columbia	4,024	4,024	100%	761	19%
Cowlitz	82,119	24,797	30%	11,099	14%
Douglas	26,205	10,965	42%	3,174	12%
Ferry	6,295	6,295	100%	670	11%
Franklin	37,473	10,226	27%	3,674	10%
Garfield	2,248	2,248	100%	500	22%
Grant	54,758	30,759	56%	6,989	13%
Grays Harbor	64,175	29,894	47%	10,190	16%
Island	60,195	39,224	65%	8,289	14%
Jefferson	20,146	10,403	52%	4,167	21%
King	1,507,319	87,544	6%	167,328	11%
Kitsap	189,731	65,743	35%	20,284	11%
Kittitas	26,725	14,364	54%	3,550	13%
Klickitat	16,616	13,297	80%	2,341	14%
Lewis	59,358	40,555	68%	9,311	16%
Lincoln	8,864	8,864	100%	1,754	20%
Mason	38,341	31,100	81%	6,326	16%
Okanogan	33,350	29,233	88%	4,647	14%
Pacific	18,882	15,981	85%	4,088	22%
Pend Oreille	8,915	8,915	100%	1,242	14%
Pierce	586,203	74,740	13%	61,247	10%
San Juan	10,035	10,035	100%	2,140	21%
Skagit	79,555	40,077	50%	12,494	16%
Skamania	8,289	8,289	100%	888	11%
Snohomish	465,642	95,118	20%	44,280	10%
Spokane	361,364	60,394	17%	47,877	13%
Stevens	30,948	26,588	86%	3,861	12%
Thurston	161,238	65,774	41%	18,799	12%
Wahkiakum	3,327	3,327	100%	648	19%
Walla Walla	48,439	12,694	26%	7,600	16%
Whatcom	127,780	52,083	41%	16,225	13%
Whitman	38,775	12,583	32%	3,665	9%
Yakima	188,823	68,407	36%	24,471	13%

Appendix A Table 1: Selected Census Data By County (1990 Census) (cont.)

County	Persons age 16 & up with mobility limitation No.	%	Persons Living Below Poverty No.	%	Persons Without Cars* No.	%
Adams	268	2%	2,360	17%	673	5%
Asotin	704	4%	3,331	19%	1,551	9%
Benton	2,528	2%	12,402	11%	5,704	5%
Chelan	1,241	2%	7,844	15%	4,891	9%
Clallam	2,169	4%	6,852	12%	4,602	8%
Clark	6,248	3%	21,910	9%	13,627	6%
Columbia	155	4%	757	19%	221	5%
Cowlitz	2,680	3%	10,747	13%	6,163	8%
Douglas	556	2%	3,170	12%	1,076	4%
Ferry	160	3%	1,484	24%	413	7%
Franklin	990	3%	8,491	23%	3,840	10%
Garfield	52	2%	231	10%	120	5%
Grant	1,350	2%	10,631	19%	3,787	7%
Grays Harbor	1,959	3%	10,306	16%	6,382	10%
Island	1,102	2%	4,156	7%	2,477	4%
Jefferson	469	2%	2,684	13%	958	5%
King	36,601	2%	117,589	8%	135,289	9%
Kitsap	4,701	2%	17,119	9%	11,722	6%
Kittitas	563	2%	4,913	18%	1,753	7%
Klickitat	388	2%	2,786	17%	1,049	6%
Lewis	1,821	3%	8,385	14%	3,993	7%
Lincoln	200	2%	1,071	12%	456	5%
Mason	1,286	3%	4,817	13%	2,030	5%
Okanogan	935	3%	7,077	21%	2,791	8%
Pacific	707	4%	3,166	17%	1,414	7%
Pend Oreille	256	3%	1,776	20%	584	7%
Pierce	15,197	3%	64,068	11%	43,704	7%
San Juan	168	2%	728	7%	390	4%
Skagit	2,662	3%	9,012	11%	4,105	5%
Skamania	263	3%	774	9%	335	4%
Snohomish	9,814	2%	30,173	6%	21,365	5%
Spokane	11,229	3%	48,027	13%	33,905	9%
Stevens	865	3%	5,249	17%	1,522	5%
Thurston	4,394	3%	15,907	10%	9,020	6%
Wahkiakum	102	3%	341	10%	110	3%
Walla Walla	1,370	3%	7,144	15%	3,710	8%
Whatcom	2,940	2%	15,142	12%	7,447	6%
Whitman	509	1%	7,827	20%	2,544	7%
Yakima	5,863	3%	37,486	20%	16,889	9%

*Number is estimated based on number of households without cars.

Appendix B

Sample Ridership Surveys

SAMPLE RIDERSHIP SURVEY

In order to improve our regional transit service, we need your input. Please complete this questionnaire and return it to your transit driver. You may also mail it to us at: [Location] **The deadline for your response is [Date].** Thank you for taking the time to complete this survey and help create a better transit service.

Please, complete only one survey per rider.

1. Today is (check one): Monday [ ] Tuesday [ ] Wednesday [ ]
   Thursday [ ] Friday [ ] Saturday [ ]

2. Time of day:__________am/pm Route________________

3. Over the past 6 months I've ridden this route:

   Occasionally [ ] Once a week [ ] 3 or more times a week [ ] Daily [ ] First time [ ]

4. I boarded this route in (check closest area):

   location 1 [ ] *location 2* [ ] *location 3* [ ] *location 4* [ ]

   Other (please list)..

5. I'm traveling to (check closest area):

   location 1 [ ] *location 2* [ ] *location 3* [ ] *location 4* [ ]

   Other (please list)..

6. The main reason for my trip today is to go: (check one only)

   Shopping [ ] School [ ] Appointment [ ] Work [ ]

   Visit friends [ ] Home [ ] Other (please list) [ ]...

7. Currently, how many working vehicles are available to members of your household:

   None [ ] One [ ] Two or more [ ]

8a. Do you drive a private vehicle yourself? Yes [ ] No [ ]

   If you answer yes to this question, skip to question 8c.

8b. If "No" to 8a, please indicate why you do not drive:

   Too young [ ] No vehicle available to me [ ] Health does not permit driving [ ]

   Other (State reason if you wish) [ ]..

   Please skip ahead to Question 9.

8c. How often do you drive a private vehicle for the following reasons:

	Occasionally	Once a Month	Once a Week	3 or more Times per week	Does Not Apply
a. Go to work:	[ ]	[ ]	[ ]	[ ]	[ ]
b. Go shopping:	[ ]	[ ]	[ ]	[ ]	[ ]
c. Go to school:	[ ]	[ ]	[ ]	[ ]	[ ]
d. Visit friends and family	[ ]	[ ]	[ ]	[ ]	[ ]
e. Other:________________ (Please list)	[ ]	[ ]	[ ]	[ ]	[ ]

For which of these trips would you consider using transit services if they were suitable?

(Please list letters of categories)...

9. My age is: Under 18 [ ] 18 - 64 years [ ] 65 years or over [ ]

10. What would make you use transit services more often? (Please give details below.)

Lower cost [ ] More frequent services [ ] Longer hours [ ] Shorter transit time [ ]

Other (Please list) [ ] ....

____

____

____

13. Do you have any other suggestions for improving your transit services?

____

____

____

Thanks for your help. Please return this survey to your coach operator.

SAMPLE COMPLEX ROUTE CHANGE SURVEY:
LINK Route 14/22: Olds Station Survey

LINK is looking at options for better service on Routes 14 and 22. One of our considerations is utilizing the Olds Station area for improving transfers between routes. We would like to know how you currently use LINK and to help us make a decision about the Olds Station area. Is it worthwhile to have Routes 14 and 22 stop in Olds Station? Please complete this questionnaire and return it to your LINK bus driver. You may also mail it to LINK at: 2700 Euclid Avenue, Wenatchee, WA 98801. **The deadline for your response is February 23.** Thank you for your time.

Please, complete only one survey per rider.

1. Today is (check one): Monday [ ] Tuesday [ ] Wednesday [ ]
   Thursday [ ] Friday [ ] Saturday [ ]

2. Time of day:__________am/pm Route________________

3. Over the past 6 months I've ridden this route:

   Occasionally [ ] Once a week [ ] 3 or more times a week [ ] Daily [ ] First time [ ]

4. I boarded this route in (check closest area):

   Leavenworth [ ] Peshastin [ ] Dryden [ ] Cashmere [ ]

   Monitor [ ] Wenatchee [ ] East Wenatchee [ ]

   Other (please list)...

5. I'm traveling to (check closest area):

   Leavenworth [ ] Peshastin [ ] Dryden [ ] Cashmere [ ]

   Monitor [ ] Wenatchee [ ] East Wenatchee [ ]

   Other (please list)...

6. The main reason for my trip today is to go: (check one only)

   Shopping [ ] School [ ] Appointment [ ] Work [ ]

   Visit friends [ ] Home [ ] Other (please list) [ ]

7a. I usually have to transfer to another route in order to complete my trip: Yes [ ] No [ ]

b. If "yes" to 7a, I will transfer to Route(s):_______ at ____________________

(street location and town).

8a. Would you like this route to stop in Olds Station? Yes [ ] No [ ] No opinion [ ]

If you answer no to this question, skip to question 9.

8b. If "Yes" to 8a, please rate each option by checking the most appropriate answer to the following options:

	Occasionally	Once a Month	Once a Week	3 or more Times per week	Don't Know
I would get off in Olds Station to:					
a. Go to work:	[]	[]	[]	[]	[]
b. Go shopping:	[]	[]	[]	[]	[]
c. Go to school:	[]	[]	[]	[]	[]
d. Transfer to another route	[]	[]	[]	[]	[]
e. Other:____________ (Please list)	[]	[]	[]	[]	[]

9. My age is: Under 18 [ ] 18 - 59 years [ ] 60 years or over [ ]

IO. I am: Male [ ] Female [ ]

11. My ethnic background is: White [ ] Hispanic [ ] African/American [ ] Native American [ ] Other [ ]

12. What is the best thing about LINK?:______________________________

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13. What can LINK do to improve its service:____________________________

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Thanks for your help. Please return this survey to your coach operator.